**SECTION 12 24 00**
**WINDOW SHADES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

A. Electrically operated sunscreen roller shades.

B. Local group and master control system for shade operation with addressable encoded motors.

C. Whole Building Shade Management System: Automated Solar Tracking Control System Computer Shade Control System.

D. Window shades shall be furnished complete, including brackets, fittings and hardware.

**1.2 RELATED WORK**

A. Section 01 81 13, SUSTAINABLE DESIGN REQUIREMENTS for additional LEED requirements.

B. Section 01 81 19, INDOOR AIR QUALITY REQUIREMENTS for VOC limit.

C. Section 06 10 00, ROUGH CARPENTRY for wood blocking and grounds for mounting roller shades and accessories.

D. Section 09 29 00, GYPSUM BOARD for coordination with gypsum board assemblies for installation of shade pockets, closures and related accessories.

E. Section 09 51 00, ACOUSTICAL CEILINGS for coordination with acoustical ceiling systems for installation of shade pockets, closures and related accessories.

F. Division 26 – Electrical for electric service for motor controls

G. Color of shade cloth and color of exposed parts of window shades: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 QUALITY CONTROL**

A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years experience and minimum of three projects of similar scope and size in manufacturing products comparable to those specified in this section.

B. Installer Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section.

C. Fire-Test-Response Characteristics: Passes NFPA 701-99 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.

D. Electrical Components: NFPA Article 100 listed and labeled by either UL or ETL or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system.

Individual testing of components will not be acceptable in lieu of system testing

E. Anti-Microbial Characteristics: "No Growth" per ASTM G21 results for fungi ATCC9642, ATCC9644, ATCC9645.

F. Environmental Certification: Submit written certification from the manufacturer, including third party evaluation, recycling characteristics, and perpetual use certification as specified below. Initial submittals, which do not include the Environmental Certification, below will be rejected. Materials that are simply 'PVC free' without identifying their inputs shall not qualify as meeting the intent of this specification and shall be rejected.

G. Third Party Evaluation: Provide documentation stating the shade cloth has undergone third party evaluation for all chemical inputs, down to a scale of 100 parts per million, that have been evaluated for human and environmental safety. Identify any and all inputs, which are known to be carcinogenic, mutagenic, teratogenic, reproductively toxic, or endocrine disrupting. Also identify items that are toxic to aquatic systems, contain heavy metals, or organohalogens. The material shall contain no inputs that are known problems to human or environmental health per the above major criteria, except for an input that is required to meet local fire codes.

H. Recycling Characteristics: Provide documentation that the shade cloth can and is part of a closed loop of perpetual use and not be required to be down cycled, incinerated or otherwise thrown away. Scrap material can be sent back to the mill for reprocessing and recycling into the same quality yarn and woven into new material, without down cycling. Certify that this process is currently underway and will be utilized for this project.

I. Perpetual Use Certification: Certify that at the end of the useful life of the shade cloth, that the material can be sent back to the manufacturer for recapture as part of a closed loop of perpetual use and that the material can and will be reconstituted into new yarn, for weaving into new shade cloth. Provide information on each shade band indicating that the shade band can be sent back to the manufacturer for this purpose.

J. Mock-Up: Provide a mock-up, if Professional requires, of one roller shade assembly for evaluation of mounting, appearance and accessories.
   1. Locate mock-up in window designated by Professional.
   2. Do not proceed with remaining work until, mock-up is accepted by Professional.

**1.4 SUBMITTALS**

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
   3. Storage and handling requirements and recommendations.
   4. Mounting details and installation methods.
   5. Typical wiring diagrams including integration of motor controllers with building management system, audiovisual and lighting control systems as applicable.

C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.
   1. Prepare shop drawings on AutoCAD or Microstation format using base sheets provided electronically by the Professional.

D. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.

E. Selection Samples: For each finish product specified, one set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.

F. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements. Shade cloth sample and aluminum finish sample as selected. Mark face of material to indicate interior faces.

G. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls

H. LEED Submittals:
   1. Credits MR 4.1 & 4.2: For products having recycled content, documentation indicating percentages by weight of post-consumer and pre-consumer recycled content.
      a. Include statement indicating costs for each product containing recycled content.
   2. Credits MR 5.1 & 5.2: For products manufactured within 500 miles of project site and whose raw materials are extracted, harvested or recovered, within 500 miles of the project site, documentation indicating the location and distance of material manufacturer and

point of extraction, harvest, or recovery for each raw material from the Project site.

a. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

**1.5 APPLICABLE PUBLICATIONS**

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced to in the text by the basic designation only.

B. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

C. NFPA 70 - National Electrical Code.

D. UL325 or Equal – Listed Solution covering all controls, electrical accessories and motors.

E. NFPA 701-99 - Fire Tests for Flame-Resistant Textiles and Films.

**1.6 DELIVERY, STORAGE, AND HANDLING**

A. Deliver shades in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings.

**1.7 PROJECT CONDITIONS**

A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

**1.8 WARRANTY**

A. Motorized Roller Shade Hardware and Shadecloth: Manufacturer's standard non-depreciating twenty-five year limited warranty.

B. Roller Shade Motors and Motor Control Systems: Manufacturer's standard non-depreciating five-year warranty.

C. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas, which are deemed Government’s responsibility.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURER**

A. Basis-of-Design: MechoShade Systems, Inc; (718) 729-2020; or approved equivalent.

B. LEED Requirements:

1. Recycled Content of Steel Products: Provide steel products with minimum 25% post-consumer recycled content

**2.2 SHADE CLOTH**

A. Environmentally Certified Shadecloth: MechoShade Systems, Inc., EcoVeil Naturals group, 8050 Series, fabricated from TPO for both core yarn and jacket, single thickness, non-raveling 0.762 mm (0.030 inch) thick fabric.
   1. Weave: 1-2% percent open 2x2 jacquard weave.
   2. Warranty: 10-Year Limited.

B. Room darkening (PVC Free) Shadecloth with opaque acrylic backing: MechoShade Systems, Inc., "Equinox 0100 series", 0.19 mm (0.008 inches) thick blackout material and weighing .94 lbs. per square yard, comprising of 53% fiberglass, 45% acrylic, 2% poly finish.

**2.3 SHADE BAND**

A. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.
   1. Concealed Hembar: Shall be continuous extruded aluminum for entire width of shade band and with the following characteristics:
      a. Hembar shall be heat sealed on all sides.
      b. Open ends shall not be accepted.
   2. Shade band and Shade Roller Attachment:
      a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection.
      b. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" snap-off" spline mounting, without having to remove shade roller from shade brackets.
      c. Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
      d. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets are not acceptable.

**2.4 ROLLER SHADE FABRICATION**

A. Roller Shade Schedule:
   1. Shade Type WT-1: Motorized interior solar roller shades in all exterior windows of rooms and spaces shown on Drawings, and related motor control systems.
   2. Shade Type WT-2: Motorized interior independently operated solar and blackout shade double shades in all exterior windows of rooms and

spaces shown on Drawings, and related motor control systems. (Exam Room and Conference Rooms).

a. WT-2 type shades shall have capability of being controlled by both Solar Tracking Control System as well as AV or Lighting System.

B. Include motorized shades with group controls and interfacing to either BMS, AV or Lighting Control Systems.

1. Roller Shade Hardware, shade fabric, motor, and all related controls shall be furnished and installed as a complete assembly.
2. All electrical and electronic controls and accessories required for a complete control system including appropriate interface to communicate with stand alone BMS, Day Lighting, AV, or central integration contractor, shall be provided as part of the contractor based proposal as separate line items listing the control / interface components provided. Equipment shall include, but not be limited to motor controllers, dry contact closures, RS-232, or RS-485 interface units, transformers, relays, and interface units.
3. Contractor shall list all components included in their bid and shall be financially responsible for any change orders and/or back charges required by the BMS, AV, or Lighting Control Systems contractors to interface with the motorized roller shade system.

C. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch (3.18 mm) in either direction per 8 feet (2438 mm) of shade height due to warp distortion or weave design. Fabricate hem as follows:

1. Concealed hemtube.

D. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shadebands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.

E. For railroaded shadebands, provide seams in railroaded multi-width shadebands as required to meet size requirements and in accordance with seam alignment. Seams shall be properly located. Furnish battens in place of plain seams when the width, height, or weight of the shade exceeds manufacturer's standards. In absence of such standards, assure

proper use of seams or battens as required to, and assure the proper tracking of the railroaded multi-width shadebands.

F. Provide battens for railroaded shades when width-to-height (W:H) ratios meet or exceed manufacturer's standards. In absence of manufacturer's standards, be responsible for proper use and placement of battens to assure proper tracking and roll of shadebands.

G. Blackout shadebands, when used in side channels, shall have horizontally mounted, roll-formed stainless steel or tempered-steel battens not more than 115 mm (3 feet) on center extending fully into the side channels. Battens shall be concealed in an integrally-colored fabric to match the inside and outside colors of the shadeband, in accordance with manufacturer's published standards for spacing and requirements.

1. Battens shall be roll formed of stainless steel or tempered steel and concave to match the contour of the roller tube.

**2.5 COMPONENTS**

A. Access and Materials Requirements:

1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.
3. Use only Delrin engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester will not be acceptable.

B. Motorized Shade Hardware and Shade Brackets:

1. Provide shade hardware constructed of minimum 3.18 mm (1/8-inch) thick plated steel, or heavier, thicker, as required to support 150 percent of the full weight of each shade. Plastic components without use of steel angle construction do not meet the intent of this specification and shall not be accepted.
2. Provide shade hardware system that allows for field adjustment of motor or replacement of any operable hardware component without requiring removal of brackets, regardless of mounting position (inside, or outside mount).
3. Provide shade hardware system that allows for operation of multiple shade bands offset by a maximum of 8-45 degrees from the motor axis between shade bands (4-22.5 degrees) on each side of the radial line, by a single shade motor (multi-banded shade, subject to manufacturer’s design criteria).

4. All bands within a single motor group shall be aligned within 1/4 inch.

**2.6 INTELLIGENT ENCODED SHADE MOTOR DRIVE SYSTEM**

A. Shade Motors:

1. Intelligent Encoded Motor & Control System: Tubular, asynchronous (non-synchronous) motors, with built-in reversible capacitor operating at 110v AC (60hz), single phase, temperature Class A, thermally protected, totally enclosed, maintenance free with line voltage power supply equipped with locking disconnect plug assembly furnished with each motor.
2. Conceal motors inside shade roller tube.
3. Maximum current draw for each shade motor of 2.3 amps.
4. Use motors rated at the same nominal speed for all shades in the same room.

B. Total hanging weight of shade band shall not exceed 80 percent of the rated lifting capacity of the shade motor and tube assembly.

C. Intelligent Encoded Motor System (Software, two-way communication): Specifications and design are based on the Intelligent Motor Control System / I*CON™ Motor System) as manufactured by MechoShade Systems, Inc. Other systems may be acceptable providing all of the following performance capabilities are provided. Motor control systems not in complete compliance with these performance criteria shall not be accepted as equal systems.

1. Upper and lower stopping points (operating limits) of shadeband's shall be programmed into motors via a hand held removable program module / configurator.
2. Intermediate stopping positions for shades shall be a minimum of 4-predefined intermediate positions, for a total of 6-defined and aligned positions. All shades on the same switch circuit with the same opening height shall align at each intermediate stopping position.
3. Encoded Motors shall be addressable via a hand-held removable program module and shall be capable of responding to a minimum of seven different user defined stored addresses including multiple overlapping sub groups and three reserved control input addresses for use by building management systems, life safety systems and other emergency inputs.
4. The system shall have the capability of two-way communication with the motors. Each motor shall allow for a unique address message to

be received from the hand held configurator and/or a PC controller or switch.

a. Bus line shall consist of 2-twisted pair of 16-gage low voltage wire.
b. Shade motor control components (bus interfaces, wall switches, bus supplies, auxiliary control input devices, and similar items) shall be connected in series via the low voltage (12VDC) two way digital communication bus line.
c. Bus line shall be capable of being installed in a free topology to provide maximum flexibility for installation and future maintenance.
d. Low voltage (12VDC), digital bus line shall be powered by a bus supply transformer, requiring 115VAC (220 - 230 VAC) input drawing a maximum current of 1 amp. A minimum of one bus supply shall be required for every 120 meters (400 linear feet) of bus line. Final bus supply spacing shall be reviewed with the system manufacturer after the number of nodes per 120 meters (400 linear feet)run of bus line has been determined.

5. Wall Switches:
   a. Conference Rooms and Exam Rooms: Shades shall be operated by a 4 & 8 button low voltage standard switches or programmable intelligent switches [IS]. Standard switch shall be wired to a bus interface and the bus interface will be programmed to transmit an address for the local switch.
   b. Intelligent switches may be installed anywhere on the busline. Each IS shall be capable of storing one control level address to be broadcast along the busline.
   c. An address that is transmitted by either a switch or central controller shall be responded to by those motors with the same address in their control table.
   d. IS shall provide for interface with other low voltage input devices via a set of dry contact terminals located on the switch.
   e. Standard switch or IS may control an individual, sub-group or group of motors in accordance with the address in each motor.
6. Touch Screen Manual Override: Provide one Color LCD Touch Screen panel per floor of designated motorized shades at locations indicated on Drawings. The touch screen shall be enabled by the touch of a finger and a map of the shades by the shade motor for the local area on that floor shall be brought up onto the screen. Each shade motor when touched shall provide a drop down menu showing preset positions.

When a preset is selected, that shade motor shall move that shade to the manually selected preset position.

**2.7 AUTOMATED DAYLIGHTING SOLAR TRACKING SHADE CONTROL SYSTEM**

A. Solar Tracking Control System: Automated Computer Shade Control System (SolarTrac-SunDialer™ Four Zone Controller as manufactured by MechoShade Systems, Inc., Long Island City, NY):

1. Control System shall adjust the shade position to maximize energy management, view and personal comfort based on micro-climactic conditions.
2. The goal is to maximize view without Thermal or Visual discomfort through:
   a. Thermal Comfort as assured by Solar Tracking.
   b. Visual Comfort as assured by managing (on the window wall).
3. Control system shall be capable of optimizing the position of the shades (incrementally), to continuously deploy the shades in response to changes in Proactive and Reactive requirements:
   a. Control Modules:
   1) Solar Tracking SunDialer Module: Base Control System:
      (a) Thermal Comfort:
         (1) Proactive Algorithms (Primary):
            (i) Sun angle.
            (ii) Solar intensity – Total Light Spectrum.
            (iii) BTU Load.
         (2) Reactive Algorithms:
            (i) Real-Time Sky Conditions via (2) Roof Mounted Radiometers.
4. Incremental Positioning:
   a. Shades shall be capable of being aligned at up to 256 Positions.
   b. The Control System shall be capable of staggering the operation of shade motors to assure balanced loading of the electrical system.
5. Continuous Operation:
   a. 24 hours per day, 7 days per week, 365-1/4 days per year.
   b. Shade positioning resolution shall be calculated every 60 seconds.

B. Graphical User Interface (GUI)

1. Configuration Screens:
   a. PC-GUI shall provide access to all adjustable parameters displaying current values including but not limited to:
      1) Radiation.
      2) Shade position.
      3) User defined requirements.

b. Displays Real-Time Microclimatic Sky Conditions (Option available).

c. Reports / Analysis Accessible from MechoShade Systems via Engineering Monitoring):

1) Data Storage: (Available as a SunDialer Option via IP Access at varying levels.)

(a) Event Log: Continual record of each day's activities including shade position and shade mode changes.

(1) Store on a change of state basis.

(2) Archived based on user defined file size.

2) Sensor Data: Daily Record of sensor's data stored into a history file on a 60 second basis:

(a) Stored on a repetitive basis.

(1) Roof mounted radiometers.

3) Control Zone timeline Visual Record of Current Day's Activity by Zone:

(a) Reporting by Zone of current day operation by intermediate stop locations.

4) Trending Reports:

(a) Daily Report – Sky, Sensors, Event Log, Timeline

(b) Shade Position Report - % of time shade at each position.

(c) Override Report – Reason for Override, % of day overridden up / down.

5) Interface with other Report Writers:

(a) Event Log and Sensor Data available in native MBD format.

(b) Available in SQL format.

C. OVERRIDE:

1. Control Software shall incorporate an Override Event Scheduler such the building owner may customize position of shades by motor, group, zone or whole building for any event, night or weekend requirements.

2. Manual Override:

a. Wall Switches.

b. Touch Screens.

c. Virtual Shade Control Switch (via IP).

3. Master Override:

a. SolarTrac SunDialer™ control system shall have capability of whole building control for master override by zone or by motor.

4. Remote Off-Site-Monitoring:

a. IP Interface for both monitoring, maintenance and software upgrades.

b. Provide Maintenance, Support and licensing contract.

**2.8 ACCESSORIES**

A. Roller Shade Pocket 4124 for recessed mounting in acoustical tile, or drywall ceilings as indicated on the Drawings for Shade Type WT-1.

B. Roller Shade Pocket 5113 for recessed mounting in acoustical tile, or drywall ceilings as indicated on the Drawings for Shade Type WT-2.

1. Provide either extruded aluminum and or formed steel shade pocket, sized to accommodate roller shades, with exposed extruded aluminum closure mount, tile support and removable closure panel to provide access to shades.

a. Provide "Vented Pocket" such that there will be a minimum of four 1 inch (25.4 mm) diameter holes per foot allowing the solar gain to flow above the ceiling line..

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 PREPARATION**

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

**3.3 ROLLER SHADE INSTALLATION**

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions, and located so shade band is not closer than 2 inches (50 mm) to interior face of glass. Allow clearances for window operation hardware.

B. Turn-Key Single-Source Responsibility for Motorized Interior Roller Shades: To control the responsibility for performance of motorized roller shade systems, assign the design, engineering, and installation of motorized roller shade systems, motors, controls, and low voltage electrical control wiring specified in this Section to a single manufacturer and their authorized installer/dealer. The Architect will not produce a set of electrical drawings for the installation of control wiring for the motors, or motor controllers of the motorized roller shades. Power wiring (line voltage), shall be provided by the roller shade installer/dealer, in accordance with the requirements provided by the manufacturer. Coordinate the following with the roller shade installer/dealer:

1. Contractor shall provide power panels and circuits of sufficient size to accommodate roller shade manufacturer's requirements, as indicated on the mechanical and electrical drawings.
2. Contractor shall coordinate with requirements of roller shade installer/dealer, before inaccessible areas are constructed.
3. Roller shade installer/dealer shall run line voltage as dedicated home runs (of sufficient quantity, in sufficient capacity as required) terminating in junction boxes in locations designated by roller shade dealer.
4. Roller shade installer/dealer shall provide and run all line voltage (from the terminating points) to the motor controllers, wire all roller shade motors to the motor controllers, and provide and run low voltage control wiring from motor controllers to switch/ control locations designated by the Architect. All above-ceiling and concealed wiring shall be plenum-rated, or installed in conduit, as required by the electrical code having jurisdiction.
5. Contractor shall provide conduit with pull wire in all areas, which might not be accessible to roller shade contractor due to building design, equipment location or schedule.

C. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

D. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

**3.4 ADJUSTING**

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

**3.5 CLEANING AND PROTECTION**

A. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Resident Engineer, before time of Substantial Completion.

**3.6 DEMONSTRATION**

A. Engage a factory-authorized service representative to train Government's maintenance personnel to adjust, operate, and maintain roller shades.

- - - E N D - - -